Space Weather Technical Forecast

Issued on Friday, 18 February 2022 at 01:00 Local

This technical forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

Space Weather Forecast Headline: G1/Minor geomagnetic storm day 3 likely late day 3.

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Solar activity has been Low over the past 24 hours, with a few minor C-class flares, some of which appear to have originated from previous region 2941, which transited to the far side on the 16th when it was still classified as Eki / Beta-Gamma. However, the most recent long duration C1 flare has originated from AR2950, which is only a simple Axx/alpha region. There are also five other numbered regions on the visible disc, most of which are also very small and magnetically simple. The largest and most complex region on the visible disc is currently AR2948, which is Dsi/beta but this appears stable and has not generated any flares. No Earth-directed CMEs were in evidence in available coronagraph imagery in the past 24 hours.

Solar Wind / Geomagnetic Activity: The solar wind speed, as measured by DSCOVR at L1, has been at slow-ambient levels, currently around 320 km/s, and peaked at 401 km/s at 17/0557 UTC. The density was mostly below average. The IMF has been weak throughout, with an initial peak of 6 nT, while the north-south component ranged from +3 to -3nT. The phi angle was predominantly positive (away from the Sun) for the first half of the day, then changed to become negative (towards the Sun).The net result of the above solar wind measures was Quiet to Unsettled (Kp 1-3) geomagnetic activity.

Energetic Particles / Solar Radiation: The high energy proton flux (greater than 10 MeV) measured at GOES 16 was at background levels. The high energy electron flux (greater than 2MeV) was at moderate levels for much of the time, but temporarily breached the High (>1000 pfu) threshold at the peak of the diurnal cycle, reaching 1.21e3 pfu at 17/1820 UTC. The corresponding 24-hour integrated electron fluence has steadily declined, dropping below the 1e8 Active level at 17/1800 UTC, with a reading of 3.86e7 integrated pfu at 18/0000 UTC.

Four-Day Space Weather Forecast Summary

Solar Activity: Solar activity is likely to remain Low through the forecast period, with C-class flares likely (60%) and a slight chance (5%) of an M-class flare. Later in the period a new region may rotate onto the visible disc, and potentially increase the probabilities of significant flares.

Solar Wind / Geomagnetic Activity: No CMEs feature in this forecast period. Solar winds are likely to remain slow until later on day 3 (20th), then becoming elevated due to the anticipated arrival of an enhancement from a coronal hole. If this was to happen Quiet (Kp 0-2) geomagnetic activity would become Unsettled to Active (Kp 3-4), with isolated G1/Geomagnetic storm (Kp 5) intervals likely during day 3 (20th).

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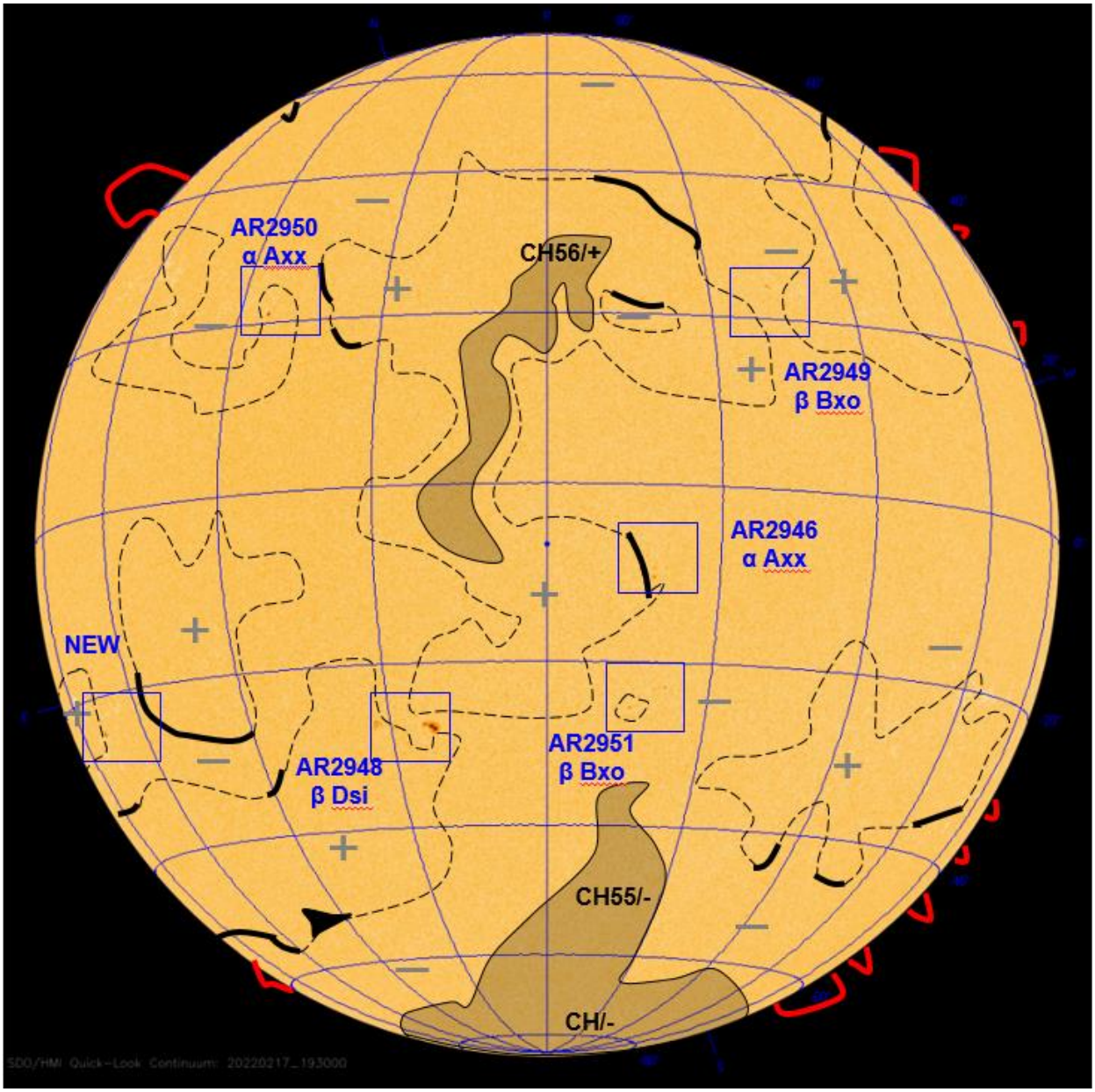
Energetic Particles / Solar Radiation: The high energy proton flux is expected to remain at background levels during the period. The High (>1000 pfu) electron flux is expected to remain below the High threshold (1000 pfu) for most of the time, perhaps breaching the threshold during day 4 (21st). The corresponding electron fluence is expected to remain below the Active (>1e8 integrated pfu) electron fluence.

Figure 1. Solar Analysis Valid 17/1930Z.



Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

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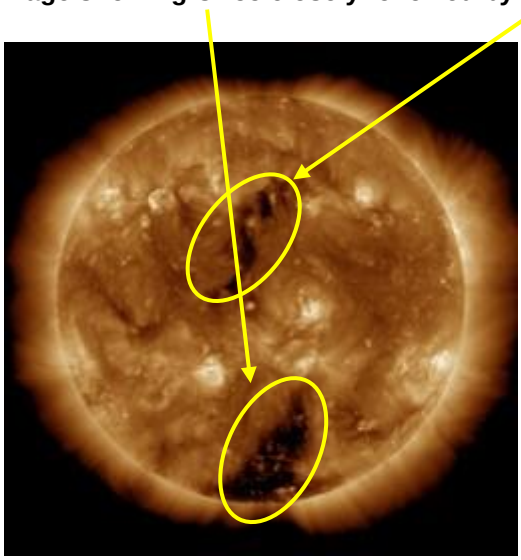
Geomagnetic Storms:

No Earth-directed CMEs feature in this forecast at present.

Solar winds are currently at slow-ambient levels. Quiet geomagnetic activity today and tomorrow (18th and 19th) with isolated Unsettled spells during any sustained periods of negative BZ. However, during day 3 (20th) into day 4 (21st) Earth is expected to connect to the high speed stream from negative coronal hole 55 (CH55/-), which is an extension of the southern crown. If this was to happen Quiet (Kp 0-2) geomagnetic activity would become Unsettled to Active (Kp 3-4), with isolated G1/Geomagnetic storm (Kp 5) intervals likely during day 3 (20th), and with a chance of isolated G1/Geomagnetic storm (Kp 5) intervals during day 4.

Geo-Magnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	No	1	1	60	40
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Figure 2: Latest SDO/AIA 193 image showing CH55 closely followed by CH56.



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Radio Blackouts - X-Ray Flares:

There are currently 6 sunspot regions on the visible disc, of these AR2948 is the largest and most complex region, but still is only a relatively simple Dsi/beta group and appears stable. The remaining regions on the visible disc are very small, weak and simple alpha or beta regions. There is also the potential that EX2936 may rotate round the eastern limb later in the period, although no obviously bright region is visible on STEREO-EUVI at the time of writing.
Solar activity is expected to be mainly Very Low, but with isolated C-Class flares likely. The most recent C1 long duration flare originated from AR2950, despite its apparent very simple Axx/alpha classification. There is a 60% probability of further C-Class flares, and a slight chance (5%) of M-Class flares.

X Ray Flares Probability	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	R1-R2 M Class	No	5	5	5	5
Very Active	R3 to R5 X Class	No	1	1	1	1

Solar Radiation Storms - (High Energy Protons):

The high energy proton flux, as measured by GOES-16 is at background levels. Solar radiation storms are not expected in the period.

Radiation Storms Probability (Exceedance)	Level (cm^{-2} sr^{-1} s^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	≥ S1	No	1	1	1	1
Very Active	≥ S3 *	No	1	1	1	1

* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)

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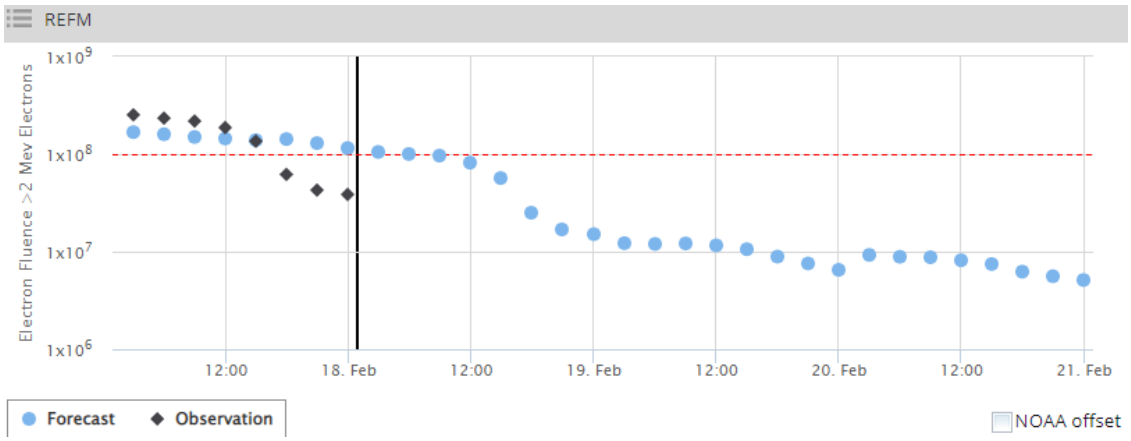
High Energy Electrons Event (≥ 2MeV):

Electron flux exceeded High levels (>1000pfu) yesterday (17th), but only temporarily at the peak of the diurnal cycle. The high energy electron flux is expected to remain below the High threshold, mainly due to slow-ambient solar winds for the first two days but then also due to increased geomagnetic activity that is expected during day 3. During day 4 (21st) an increasing trend is expected under the influence of the arrival of a HSS from CH55.
The corresponding fluence declined below the Active (1e8 integrated pfu) threshold yesterday, and is expected to persist below the threshold through the rest of the forecast period. However, an increasing trend in the fluence is expected through day 4 (21st). The Met Office REFM output is therefore considered to be offering good guidance.

GEO Electron Environment Probability (Exceedance)	Level (cm^{-2} sr^{-1} day^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ 2 MeV ≥ $1x10^8$**	Yes	40	20	10	40
Very Active	**≥ 2 MeV ≥ $1x10^9$**	No	1	1	1	1

Figure 3: Met Office REFM Model.



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